

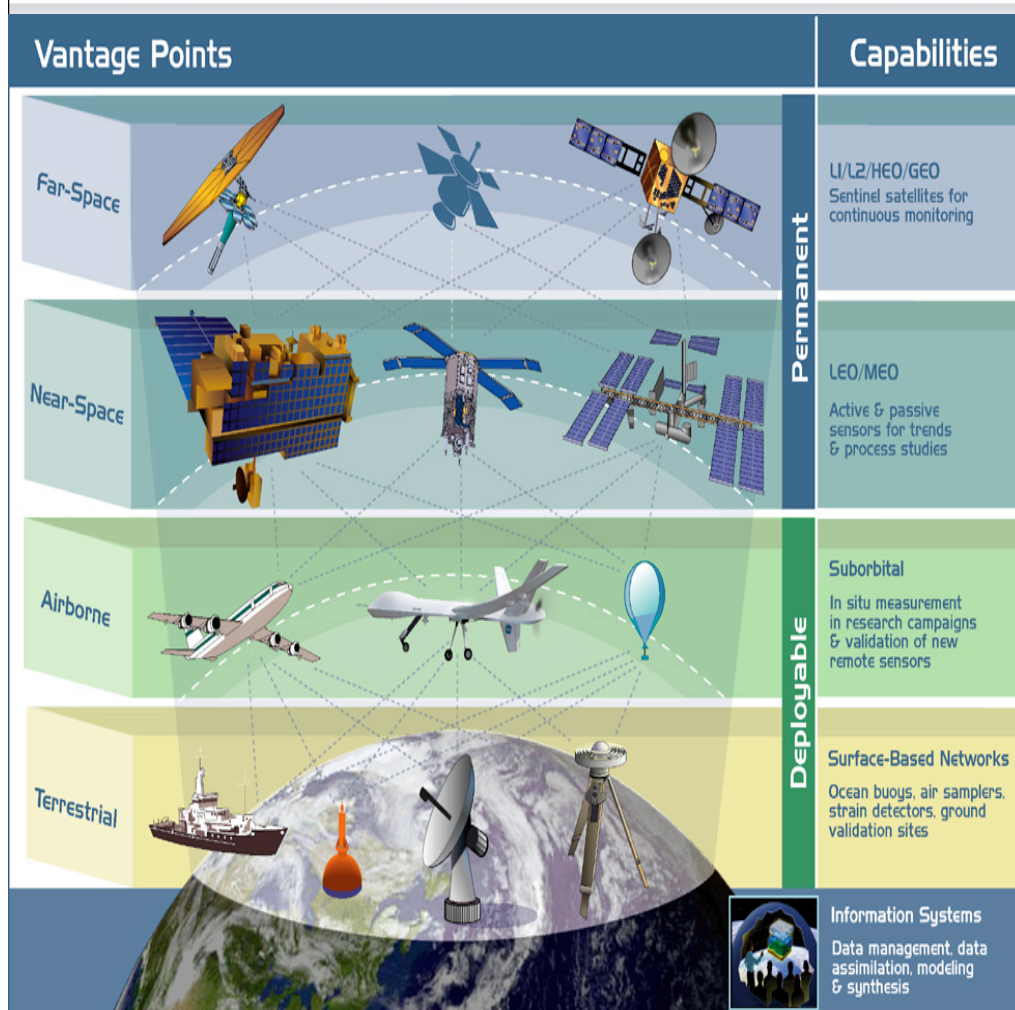
**Suborbital Science
Program**

Dryden Flight Research Center

Jacques Vachon
Deputy Director
Science Mission Directorate



Airborne Science Program



Program Objectives: Satellite Calibration and Validation

Provide methods to perform the cal/val requirements for Earth Observing System satellites

New Sensor Development

Provide methods to reduce risk for new sensor concepts and algorithm development prior to committing sensors to operations

Process Studies

Facilitate the acquisition of high spatial/temporal resolution focused measurements that are required to understand small atmospheric and surface structures which generate powerful Earth system effects

Airborne Networking

Develop disruption-tolerant networking to enable integrated multiple scale measurements of critical environmental features



Dryden Flight Research Center - Overview

Dryden supports the NASA Airborne Science Program and the nation in the following elements:

ER-2

Provide this unique, high altitude research platform to the research community

Ikhana (Predator B) & Global Hawk

Provide access to developmental UAS capability

REVEAL

Disruption-tolerant airborne networking over-the-horizon

G-3

Provide a flexible, mid-range platform to the science community

DC-8

Flying laboratory, provide heavy lift platform and multiple instrument capability

ER-2

Capabilities

- Endurance > 10 hours
- Ceiling > 70,000 ft
- Payload 2,600 lbs
- Range > 4,000 nautical miles

Mission Support Features

- Multiple locations for payload instruments
- Pressurized and un-pressurized compartments
- Standardized cockpit control panel for activation and control of payload instruments.
- Iridium communications system
- World-wide deployment experience



Background and Status

- U-2 and ER-2 aircraft have been a mainstay of NASA airborne sciences since 1971
- Over 100 science instruments integrated
- Continuous capability improvements
- Two aircraft currently available for:
 - Remote sensing
 - Satellite calibration/validation
 - In-situ measurements and atmospheric sampling
 - Instrument demonstration, test and evaluation

Ikhana (Predator B)

Capabilities

Endurance: 30 hours

Ceiling altitude > 40,000 ft

Payload > 2,000 lbs (750 in pod)

Range: 3,500 nautical miles

Standard MQ-9 w/digital engine control

Mission Support Features

Airborne Research Test System

- enables effective flight control research

Mobile ground control station

- supports campaign deployment

External experimenter pod

- rapid/flexible experiment integration



Status

'Mission Ready' date - June, 2007

- A/C delivered in Nov. 2007
- NASA pilots and crew
- NASA unique systems in progress

Science Campaigns:

- Western States Fire Mission 2007

Cost-sharing with non-SMD projects

- Fiber Optic Wing Sensor



Global Hawk

Capabilities

Endurance > 30 hours

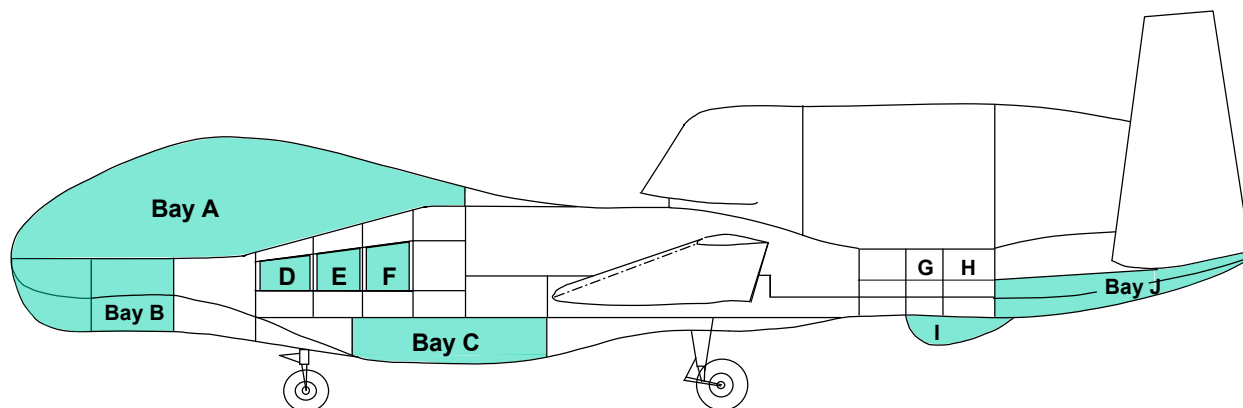
Range > 11,000 nmi

Altitude 65,000 ft

Payload > 1,500 lbs

DC Power 2.0 KW

AC Power 8.3 KVA



Mission Support Features

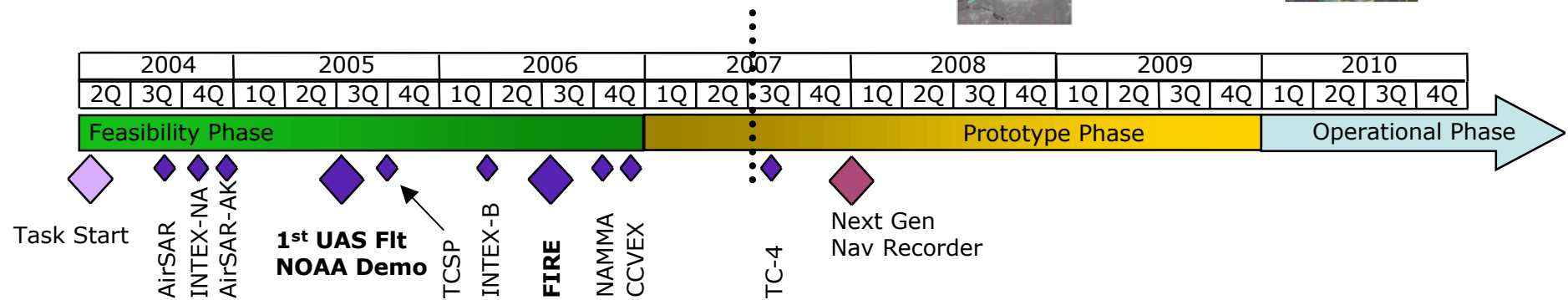
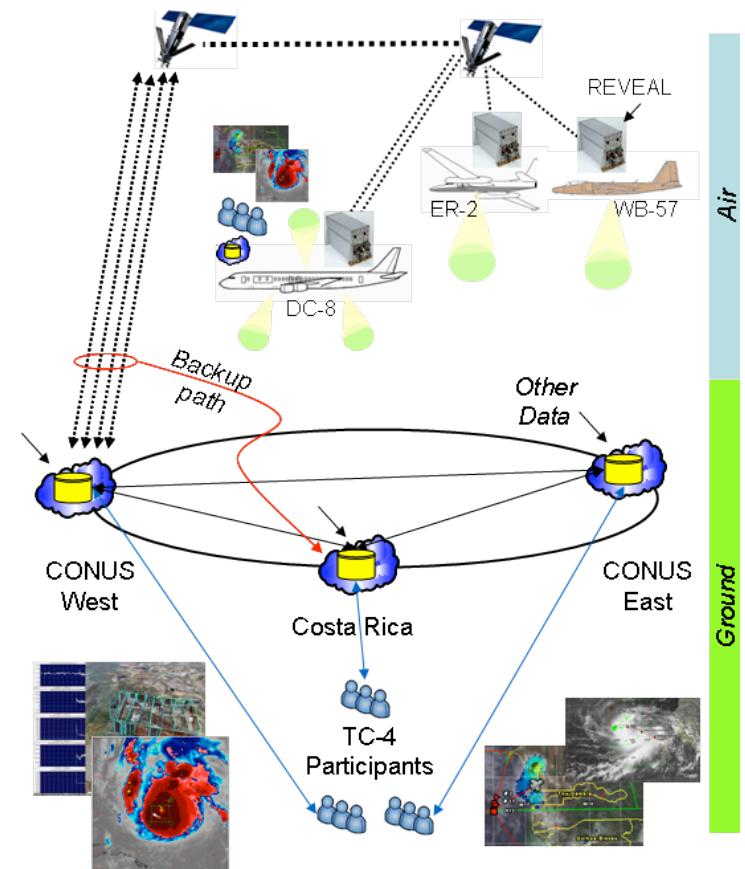
- Multiple payload locations.
 - Pressurized and un-pressurized.
 - Can accommodate wing pods (future).
- REVEAL system with ethernet network on the aircraft for payload C2/status.
- Fully autonomous control system, take-off to landing.
- Redundant LOS and BLOS aircraft command and control comm links.
- Redundant BLOS ATC comm links.
- Available by Summer, 2009



Suborbital Telepresence

Objectives

- Develop/demonstrate low-cost services for science payloads
 - Situational awareness
 - Decision support; productivity
 - Sensor web: *i.e.* Instrument interaction/C4I
- Applicable to all suborbital platforms, but special significance for UAS applications



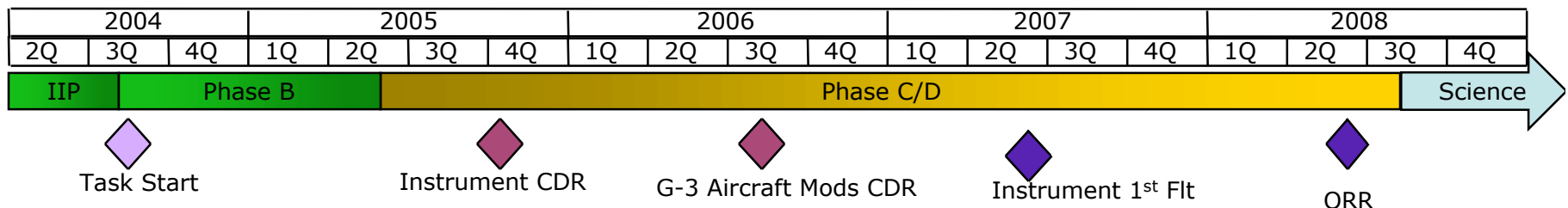
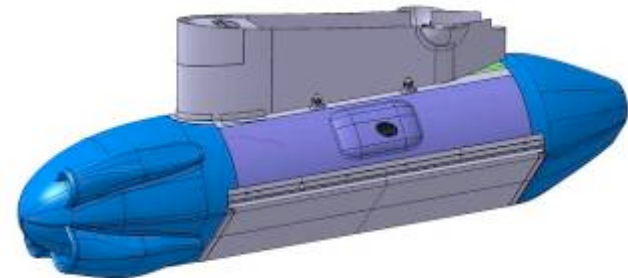
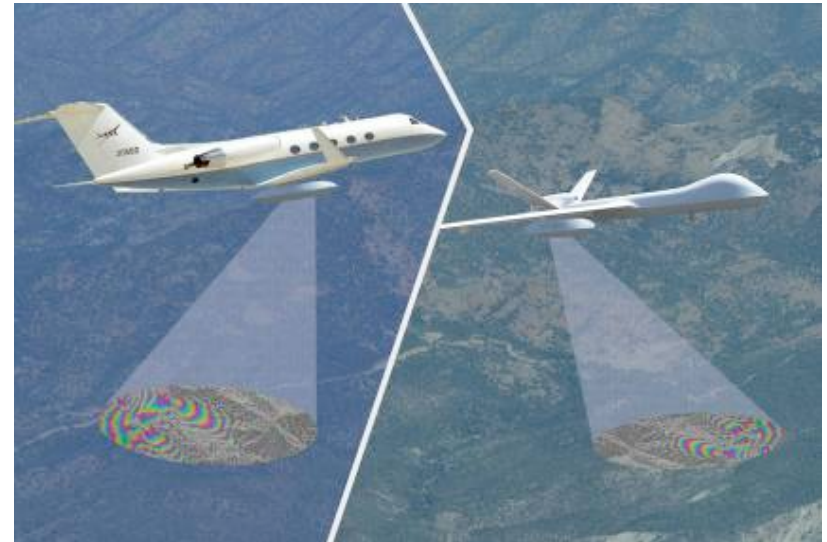
G-3 with UAVSAR

- **Mission Objective**

- Provide new capability for solid earth science
 - Airborne repeat-pass radar imaging
 - Interferometric mapping of deforming surfaces

- **Description**

- Synthetic aperture radar
- Pod mounted instrument
- < 10 m tube flight path using JPL real-time DGPS and Dryden Platform Precision Autopilot
- Compatible with Gulfstream G-3 or UAS
- Ready for other applications



DC-8

Capabilities

- **Ceiling 42,000 ft.**
- **Duration 12 hours**
- **Range > 5,400 nautical miles**
- **Payload 30,000 lbs**
- **4 CFM56-hi-bypass turbofan engines**

Mission Support Features

- **Shirt sleeve environment for up to 30 scientist/investigators**
- **Worldwide deployment experience**
- **Extensive modifications to support in-situ and remote sensing instruments, including zenith and nadir viewports, wing pylons, modified power systems, 19 inch rack mounting, extensive on-board data acquisition system, and on-board experiment network**



Background and Status

- Acquired by NASA in 1986
- Long history of supporting studies in archaeology, astronomy, ecology, geology, hydrology, meteorology, oceanography, volcanology, atmospheric chemistry, soil science and biology
- Aircraft operations transferred to Dryden Flight Research in August, 2007. Ready and available.



Airborne Science - Summary

Dryden Capabilities include:

- Aeronautics history of aircraft developments and milestones
- Extensive history and experience in instrument integration
- Extensive history and experience in aircraft modifications
- Strong background in international deployments
- Long history of reliable and dependable execution of projects
- Varied aircraft types providing different capabilities, performance and duration

For more information, contact:

- Robert Curry, (661) 276-3715, robert.e.curry@nasa.gov
- Jacques Vachon, (661) 276-5318, jacques.j.vachon@nasa.gov